

# On a small collection of millipedes (Diplopoda) from northern Pakistan and its zoogeographic significance

by

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With 13 figures

## ABSTRACT

A small collection of Diplopoda taken from northern Pakistan has proved to be important not only because it happens to contain a genus and two species described as new to science — *Quasidesmus puschtun* n. gen., n. sp. (Pyrgodesmidae, Polydesmida) and *Siphonophora duschman* n. sp. — but also due to its outstanding zoogeographic interest obviously marking the northwesternmost outpost in the distribution of a generally Oriental millipede fauna.

## INTRODUCTION

The fauna of Diplopoda of Central Asia south of Soviet Middle Asia may most generously be termed as very poorly known. This holds especially true for the vast area covering entire Pakistan and Afghanistan, as well as northwestern India and western China. Despite both the region's and the group's obvious, even outstanding zoogeographic importance, the mountainous regions supporting the upper and middle parts of the Indus basin and framed by the great chains of the Hindu Kush and Hindu Raj from the west, and by the Karakorum, northernmost Himalaya and Pir Panjal from the east, can boast to be one of the globe's utmost enigmas as regards the millipede fauna.

As regards Kashmir and Ladakh, SCHUBART (1935) was the very first to name a diplopod originating from that area: *Kaschmiriosoma contortipes* Schubart, 1935

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(Paradoxosomatidae, Polydesmida) taken in Indus Valley and at Matayan near Dras, Himalaya Main Range, Kashmir. SILVESTRI (1936) not only rediscovered this species from topotypes, but also added a *Polyxenus* sp. (Polyxenidae, Polyxenida) from the vicinity of Srinagar. More recently, MAURIÈS (1982) described a third Kashmir millipede, *Kashmireuma nielseni* Mauriès, 1982 (Kashmireumatidae, Chordeumatida), and GOLOVATCH (1983a, 1984), besides publishing on additional samples of *Kaschmiriosoma contortipes* from both Himalaya Main Range and Pir Panjal Mts., named a fourth local species, *Kronopolites occidentalis* Golovatch, 1983 (Paradoxosomatidae) from the Pir Panjal. Finally, ENGHOFF (1986) reported on some Kashmir *Anaulaciulus* (Julidae, Julida) still to be described.

In his synopsis of the Diplopoda of India, ATTEMS (1936) put on record the first few forms originating from the territory of modern North Pakistan. These species, nowadays known as *Kaschmiriosoma pleuroptera* (Attems, 1936), *Delarthrum obscurum* Attems, 1936 (both Paradoxosomatidae), and *Bollmania kohalana* (Attems, 1936) (Caspiopetalidae, Callipodida), still remain the only known Pakistani millipedes. Besides, *Kaschmiriosoma nulla* (Attems, 1936) was reported from the environs of Chamba, Himachal Pradesh, northern India.

As regards Afghanistan, Dr. H. Lohmander identified and even named preliminarily a few diplopod novelties taken there from a number of caves (s. LINDBERG, 1961, 1962), but died, having left his new taxa nomina nuda. As a result, the Afghani list comprises at the present only the anthropochorous ubiquitous *Nopoiulus kochii* (Gervais, 1847) (mentioned as *N. venustus* Meinert, 1868) (Blaniulidae, Julida) and the Central Asian *Usbekodesmus redikorzevi* Lohmander, 1932 (Polydesmidae, Polydesmida) (known also from Uzbekistan and Tadzhikistan, Soviet Middle Asia), while at least two, obviously new *Kaschmiriosoma* (sub *K. afghanistanum* nom. nud. and *K. nuristanum* nom. nud.), (a) *Bollmania* sp. (p.), as well as a new ?*Desmoxytes* (referred to as *Pratinus lindbergi* nom. nud.) (Paradoxosomatidae) and one more, yet obscure ?Polydesmoidea (*Afghanodesmus tcheheli* nom. nud.) still await a description.

To my knowledge, this brief historical review provides a full account of the state of the art in the regions concerned. Although those harsh mountainous lands hardly support a particularly rich millipede fauna, the anticipated species diversity must certainly be considerably greater than the above handful. No wonder that any collection from there may very soundly be expected to yield highly important results.

As if to prove the above statement, through the kind assistance of Dr. I. Löbl, of the Muséum d'Histoire naturelle, Geneva (MHNG), I was privileged to recently examine a small material of Diplopoda taken in northern Pakistan in 1983 by Drs Cl. Besuchet & I. Löbl during an entomological expedition. Although the Paradoxosomatidae and Julidae had been sent for study to Dr. C. A. W. Jeekel (Amsterdam) and Dr. H. Enghoff (Copenhagen), respectively, the remaining groups appear to be sufficiently interesting, both systematically and zoogeographically, to receive special attention.

The purpose of the present paper is not only to put on record the few millipedes taken from practically a terra incognita, important enough though, for one genus and two species are described here as new to science, but also to provide a preliminary outline of diplopod zoogeography of the region concerned in toto.

The materials treated have mainly been returned to the MHNG, some duplicates have been housed in the Zoological Museum of the State University of Moscow (ZMUM), Zoologisk Museum, Copenhagen (ZMUC), and Senckenberg Museum, Frankfurt/M. (SMF), as indicated hereinafter.

Before going further, I wish to express my cordial thanks to Dr. I. Löbl for enabling me to treat his valuable collection shedding in general quite a surprising light on the faunal composition of Diplopoda of northern Pakistan. Dr. H. Enghoff (ZMUC) kindly provided constructive criticism of the paper.

## TAXONOMY

Order Callipodida  
Family Caspiopetalidae

### **Bollmania** sp(p.)

Material: 3 ♀ (MHNG), Pakistan, Hazara: Shogran, 2400 m, litter under bushes at edge of *Pinus* forest, 3.VI.1983. — 1 juv. (MHNG), Hazara: above Kaghan, 2150 m, under stones along stream, 2.VI.1983. — 3 juv. (MHNG), Swat: Malam Jabba, 2300-2400 m, under *Pinus* & *Juglans*, 9.V.1983; all leg. Cl. Besuchet & I. Löbl.

Remarks: *Bollmania* Silvestri, 1896 is a callipodidan genus at the moment represented by 7 described Central Asian species or subspecies (see key in GOLOVATCH, 1983b). Of them, only *B. kohalana* (Attems, 1936) has been described from Pakistan, namely from Kohala. Unfortunately, in the absence of males and/or reliable geographic record, it appears impossible to determine the samples at hand closer to species.

It seems also noteworthy that a *Bollmania* or *Bollmania*-like callipodidan has been reported from southern China (GOLOVATCH, 1981), and still another genus (and family?) has just been received from there for study by Dr. J.-P. MAURIÈS (personal communication).

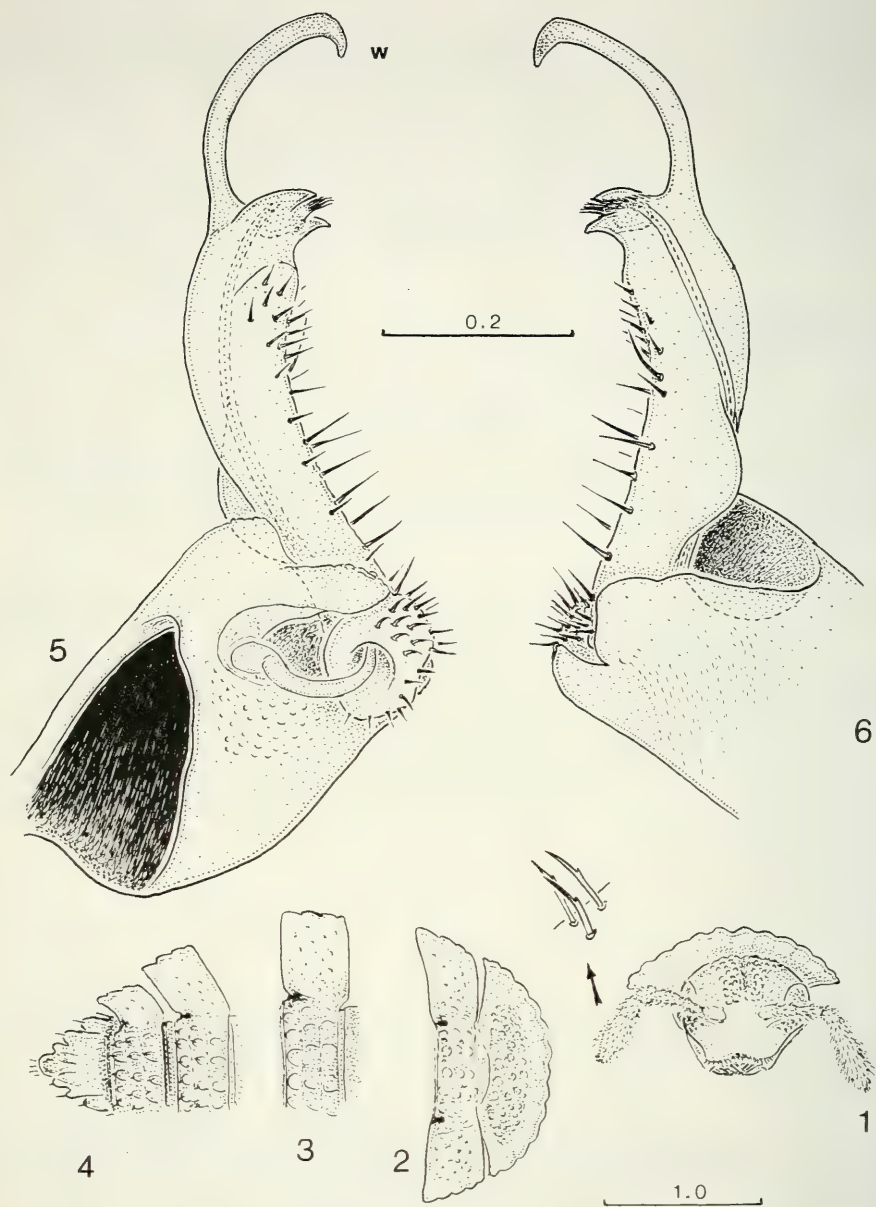
Order Chordeumatida  
Family Heterochordeumatidae

### gen. sp.

Material: 1 ♀ (MHNG), Pakistan, Swat: Malam Jabba, 2300 m, *Pinus* forest, litter, 19.V.1983; leg. Cl. Besuchet & I. Löbl.

Remarks: This small, ca. 10 mm long, platydesmoid-like, brownish, adult female with 30 body segments, with metaterga irregularly and densely multituberculate, each with the usual 3 + 3 short setae in a transverse row, with prozona finely alveolate, deviates from both hitherto known genera of Heterochordeumatidae in having only 30 somites. Unfortunately, a fuller account is impossible in the absence of a male in the sample at hand.

Zoogeographically, this discovery is quite striking, as Heterochordeumatidae have heretofore been registered only in Burma and Sumatra. Furthermore, the relatively well-explored chordeumatidan fauna of Nepal contains no heterochordeumatid species, a fact rather difficult to explain (see below).



FIGS 1-6.

*Quasidesmus puschtun* gen.n., sp. n., ♂♂ paratypes from Malam Jabba: 1, head and collum, frontal view. 2, collum and somite 2, dorsal view. 3, left half of somite 10, dorsal view. 4, left half of posterior body end, dorsal view. 5, gonopod, mesal view. 6, gonopod lateral view. — Scales in mm.



Order Polydesmida  
Family Polydesmidae

***Usbekodesmus swatensis* sp. n.**

Material: Holotype ♂ (MGNG), Pakistan, Swat, Malam Jabba, 2400 m a. s. l., under stones, 9.V.1983, Cl. Besuchet & I. Löbl leg. — Paratypes: 3 ♀ (MHNG), 1 ♀ (ZMUC), same data as holotype. — 1 ♂, 4 ♀ (MHNG), same locality, sifted leaves, mosses, *Polyporus*, grass, 9.V.1983. — 1 ♂, 1 ♀ (MHNG), 1 ♂ (ZMUC), same locality, 2300 m, under *Pinus & Juglans*, 9.V.1983. — 1 ♀ (MHNG), 2500-2600 m, *Abies* forest, sifted litter, 18.V.1983. — 2 ♀ (SMF), Swat, above Miandam, 2300 m, under bark of big *Abies* log, 10.V.1983. — 4 ♀ (MHNG), same locality, 2400-2500 m, *Abies* forest, under stones, 17.V.1983. — 1 ♂, 1 ♀ (ZMUM), same locality, litter & mosses, 17.V.1983, all leg. Cl. Besuchet & I. Löbl.

Remarks: This interesting new species will be described elsewhere. The only noteworthy observations refer to both its remarkable size dimorphism of the sexes, with the female almost twice as big as the male, and its partial sympatry and syntopy with still another, somewhat smaller polydesmid (? congener) (see just below).

?***Usbekodesmus* sp.**

Material: 1 ♀ (MHNG), Pakistan, Swat: Malam Jabba, 2400 m, under stones, 9.V.1983. — 2 ♀ (MHNG), same locality, 2300 m, under *Pinus & Juglans*, 9.V.1983. — 7 ♀ (MHNG), Swat: Ushu Valley, upstream from Kalam, 2300 m, *Cedrus* forest, under *Corylus*-like bushes, 15.V.1983. — 1 ♀ (MHNG), Swat: above Miandam, 2400-2500 m, *Abies* forest, litter & mosses, 17.V.1983. — 5 ♀ (MHNG), Dir: Lawarai Pass, 2700 m, under stones, 21.V.1983. — 2 ♀ (MHNG), Hazara: above Naran, side valley, 2600 m, under *Castanea*, 1.VI.1983; all leg. Cl. Besuchet & I. Löbl.

Remarks: Unfortunately, in the absence of males, it appears impossible to identify this species closer. When this form occurs together with the previous one, it is rather easily distinguished by the somewhat smaller body size and certain somatic features.

Zoogeography of *Usbekodesmus* will be dealt with in due detail further below.

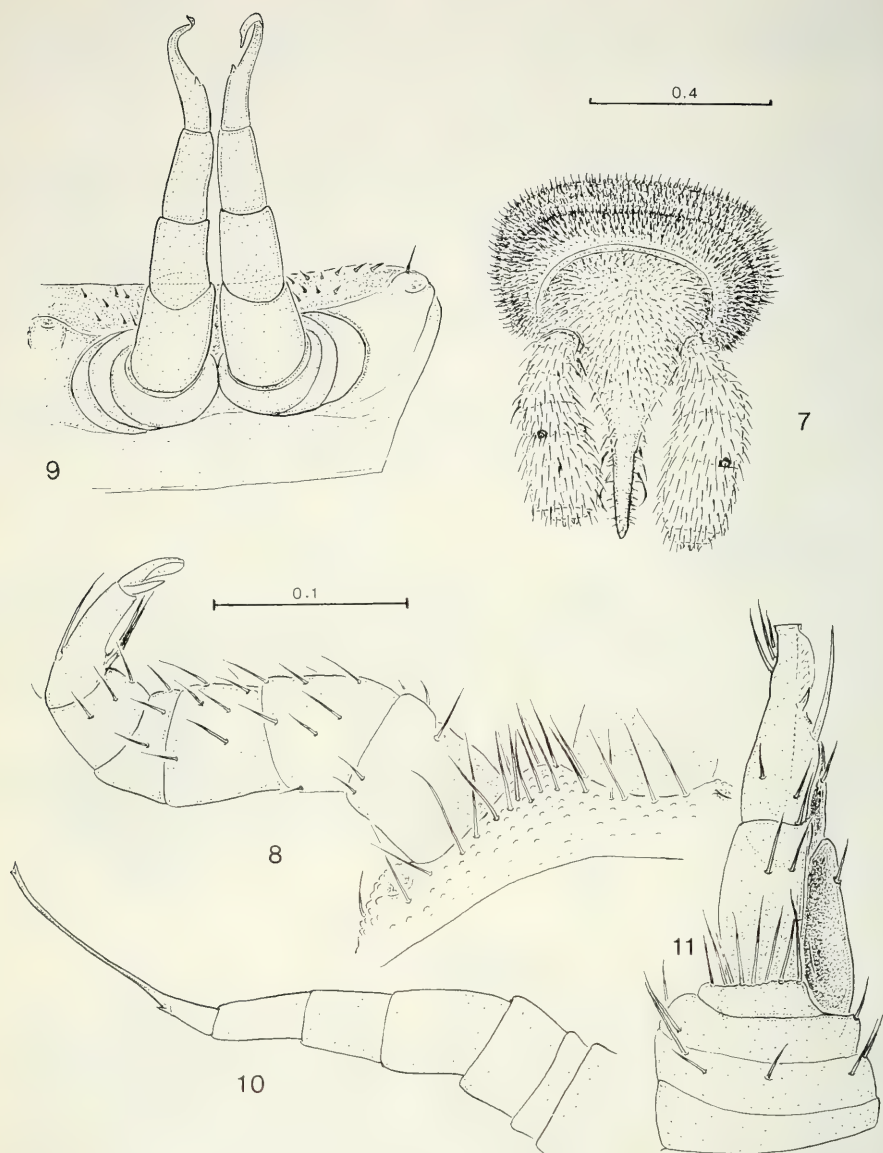
Family Pyrgodesmidae

***Quasidesmus* gen. n.**

Type-species: *Quasidesmus puschtun* sp. n.

Body small (ca. 1 cm long), with 20 somites, habitus cryptodesmoid. Head roughly tuberculate on vertex. Antennae with a group of distodorsal sensillae on joints 5-7 each, antennomere 6 about twice as long as 5th. Collum flabellate, anteriorly lobulate, covering entire head. Pore formula normal, ozopores lie laterally on margin or a little below it on second lateral lobule from behind, at about midlength of paranota, without porosteles. Dorsum very convex, paraterga extremely well-developed, broad, normally directed ventrolaterad, 4-lobulate laterally and deeply incised caudally at base. Surface rough, microporous, middorsum of metatarga with three transverse rows of moderate, subequal, setiferous tubercles. Epiproct subapically curved ventrad so that bases of apical bristles remain invisible from above.

Legs without modifications in both sexes, relatively short, practically fully invisible from above. Sterna unmodified, only between ♂ legs 6 & 7 considerably and between ♂ leg-pair 5 less so deeply excavated for accomodation of gonopods.



FIGS 7-11.

*Siphonophora duschman* sp. n., ♂♂ paratypes. 7, head, collum and somite 2, frontal view. 8, leg-pair 8, frontal view. 9, posterior gonopods of ♂ with 52 somites, ventral view. 10, same of ♂ with 75 somites, lateral view. 11, right anterior gonopod of ♂ with 75 somites, caudolateral view. — Scales in mm.

Gonopod aperture very large, transverse-subovoid. Gonopods simple, suberect, in situ parallel to main axis. Coxites relatively small, naked, medially fused, anteriorly each excavated distoventrally, with a paramedian tubercle and a well-developed cannula, as well as with a distolateral and a distomesal lobe. Prefemoral portion setose, slender, with evidence of torsion. Femoral part underdeveloped, small, poorly set off from prefemur, distally branching. Seminal groove running chiefly laterally to terminate at base of distofemoral outgrowths into a sort of accessory seminal chamber supplied with a kind of hairy pulvillus.

Remarks: Judged from certain habitual characters such as the flabellate collum, regular pattern of middorsal tuberculation against the background of a microporous rough surface, drastically curved epiproct, etc., *Quasidesmus* gen. n. is a doubtless Pyrgodesmidae. However, it differs from most/all pyrgodesmids in having neither porosteles, nor differentiated middorsal tuberculation, nor leg modifications, nor complicated gonopod structure, nor a solenomerite branch. Moreover, the presence of a deep incision at the base of a paranotum and, especially, the gonopod conformation vividly remind of certain Cryptodesmidae as redefined by HOFFMAN (1973), although the absence of a solenomerite branch alone makes *Quasidesmus* gen. n. well disjunct from most of the cryptodesmids proper. As if to further reinforce this combination of peculiarities which is in itself sufficient enough to justify a new genus, the really unique presence of a sort of accessory seminal chamber and a pulvillus rather characteristic of the Polydesmidae isolates *Quasidesmus* gen. n. particularly profoundly. It must be noted that this chamber seems rather to be a deep hollow in *Quasidesmus* gen. n., therefore being only an analog of this structure in the true Polydesmidae. The same holds true for the pulvillus, as it only looks hairy, being actually composed of spikes.

The various traits separately met with in very different polydesmidean lineages (the above three families belong to two different superfamilies, according to both HOFFMAN, 1979, and SIMONSEN, 1990) and as if combined in *Quasidesmus* gen. n. make the latter not only very readily recognizable, but also question some points of the order's higher classification. In this respect, SIMONSEN's (1990) scepticism for and criticism of some of HOFFMAN's (1979) ideas seem fully merited.

In any event, *Quasidesmus* gen. n. is quite a good cryptodesmid in the older sense of ATTEMS (1940). Its actual affinities can hardly be adequately outlined until more comparative materials, especially those deriving from the Himalayas, have been studied (see below).

### *Quasidesmus puschtun* sp. n.

Figs 1-6.

Material: Holotype ♂ (MHNG), Pakistan, Swat: Malam Jabba, 2300 m, *Pinus* forest, under *Pinus* & *Juglans*, 9.V.1983; leg. Cl. Besuchet & I. Löbl. — Paratypes: 2♂, 2♀, 1 juv. (19 segm.) (MHNG), same locality and date, together with holotype. — 1♂ (ZMUM), same locality, 2400 m, in grasses, mosses, *Polyporus* & rotten wood, 9.V.1983. — 1♂, 2 juv. (SMF), Swat: above Miandam, 2400-2500 m, *Abies* forest, in dead leaves and mosses, 17.V.1983. — 1♂ (ZMUC), same locality, 2300 m, under bark of large *Abies* log, 10.V.1983. — 1♂, 1♀, 2 juv. (19 segm.) (MHNG), same locality, 2300 m, at big *Abies* stump, 10.V.1983. — 1 juv. ♂ (19 segm.) (MHNG), Dir: Lawarai Pass, 3000 m, sifted litter under big *Pinus* tree, 21.V.1983. — 1 juv. ♂ (19 segm.) (MHNG), same locality, 2700 m, under stones, 21.V.1983; all leg. Cl. Besuchet & I. Löbl.

**Etymology:** Named after the main people populating the area concerned.

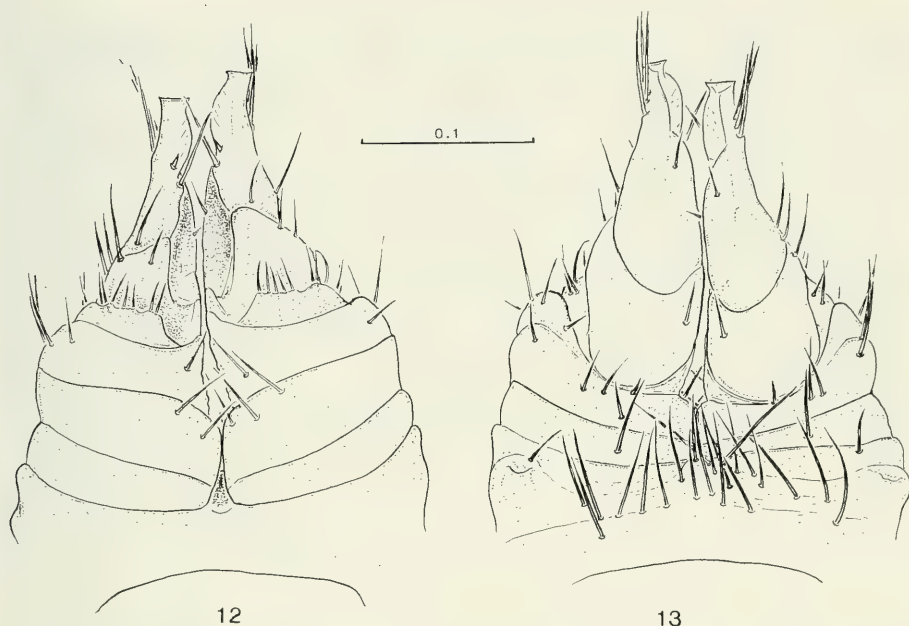
**Description.** Length of adults ca. 9-10 ( $\sigma\sigma$ ) and 10-11 mm ( $\varphi\varphi$ ), of juveniles (19 segm.) ca. 7.5 mm; width of adults 0.7-0.95 and 1.7-2.0 ( $\sigma\sigma$ ), and 0.9-1.0 and 1.8-2.0 mm ( $\varphi\varphi$ ) on midbody pro- and metazona, respectively; juveniles (19 segm.) 0.6 and 1.2-1.3 mm wide on midbody pro- and metazona, respectively. Holotype ca. 9.0 mm long, 0.7 and 1.8 mm wide on midbody pro- and metazona, respectively. Coloration of adults pinkish-yellow, somewhat brighter on anterior body third, juveniles paler.

**Head** (Fig. 1) considerably narrower than collum, bare, vertex and genae roughly tuberculate; antennae relatively long and slender, in situ reaching to end of somite 2, moderately clavate, densely clothed with peculiar setae each supplied with a denticle at distal third, joints 5-7 each with a distodorsal group of minute bacilliform sensillae, joint 6 ca. twice as long as 5th. Body with 20 somites. Collum (Figs 1-2) flabellate, covers entire head from above, anterior margin 12-lobulate (regardless of 1+1 incomplete lobules at caudal corners) and somewhat elevated, middorsum densely and irregularly tuberculate. Somite 2 (Fig. 2) much broader than collum, almost equal in width to somite 3, whereupon body parallel-sided until ring 17, onward rapidly tapering. Tergal surface generally microporous, rather rough and dull. Middorsum well convex, its tuberculation remains not differentiated but regular, all tubercles being subequal in size and arranged in three transverse rows on metaterga (Figs 2-4). Most of tubercles with setae already broken off, usually retained only on a few posteriormost metaterga, very short and subclavate. Paranota very well-developed, start already from collum, set at about dorsal third and directed obliquely ventrolaterad to reach level of sterna, cover entire legs from above, both anterior and posterior margins mostly straight, both anterolateral and posterolateral corners mostly subrectangular, posterior corner being acute only on somites 2 and (less so) 3, as well as on somites 17-19 where inclination to the rear is particularly marked. Lateral edge of paranota very modestly 4-lobulate, anteriormost lobule being particularly small and second lobule from behind bearing ozopores on somites 5, 7, 9, 10, 12, 13, 15-19. Ozopores inconspicuous, without porosteles, open laterally until somite 16, on rings 17-19 already ventrally a little below respective lobule. Base of all paranota but collum with a deep caudal incision. Both suture between pro- and metazona and prozona proper very finely alveolate, shagreened. Pleurosternal carinae or swellings absent. Epiproct relatively massive, with 4+4 lateral setiferous tubercles, in lateral view finger-shaped, near tip drastically curved ventrad so that bases of 4 long apical setae remain invisible from above (Fig. 4), in dorsal view short, rounded, scapuliform. Subanal scale relatively large, roundly-subtriangular, with a pair of rather small, paramedian, setiferous knobs at rear margin. Anal valves relatively small, flattened, very prominently margined.

Legs relatively short and stout (except for tarsi), densely setose, subequal in both sexes, without special modifications, claws simple, short, slightly curved. Coxae 2 with evident vasa deferentia openings distoventrally. Sterna moderately setose, without particulars except for being well excavated between  $\sigma$  leg-pairs 6-7 and, less so, between  $\sigma$  leg-pair 5 for gonopods to hinge into.

Gonopod aperture very large, transverse-subovoid, fore edge narrow; normal both frontal and aboral shelves supporting gonocoxae well-developed. Gonopods proper (Figs 5-6) simple, suberect, in situ hold parallel to main axis. Coxites relatively small, medially fused and carrying a paramedian pair of anterior tubercles, asetose, each distoventrally deeply excavated, with a distomesal and a distolateral lobe, mesally carrying a good cannula. Telopodite slender, mostly consists of a setose prefemur. Femoral part very small, poorly demarcated from prefemoral one, apically crowned with a couple of





FIGS 12-13.

*Siphonophora duschman* sp. n., ♂ paratype with 52 somites. 12, anterior gonopods, caudal view. 13, same, frontal view. — Scale in mm.

shorter and stronger teeth ventrally and a long, simple, unciform and subflagelloid process dorsally (*w*). Seminal groove runs mainly laterally (so telopodite with evidence of torsion) to terminate into a sort of accessory seminal chamber supplied with a kind of hairy pulvillus between both distoventral teeth.

Order Siphonophorida  
Family Siphonophoridae

***Siphonophora duschman* sp. n.**

Figs 7-13

Material: Holotype ♂ (MHNG), Pakistan, Swat: above Miandam, 2300 m, under bark of big *Abies* log, 10.V.1983; leg. Cl. Besuchet & I. Löbl. — Paratypes: 1♂, 4♀, 1 juv. (MHNG), 1♂, 1♀ (ZMUM), 1♀ (ZMUC), 1♀ (SMF), same locality and date, together with holotype.

Etymology: «Dushman» means «rebel» in the Pushtuni.

Diagnosis: Differs from congeners in having a distodorsal field of sensillae only on antennomere 5 combined with certain details of gonopod structure.

Description. Length of adults ca. 9-20 mm, midbody width 0.7-0.9 mm regardless of the sex. Body length varies so considerably due to segment number variations ranging from 52 (-1) (length ca. 9 mm, width 0.7 mm) to 75 (-1) (length ca. 18 mm, width 0.9 mm) in ♂♂ and from 66 (-1) (length ca. 15 mm, width 0.8 mm) to 87 (-1) (length ca. 20 mm, width 0.9 mm) in ♀♀; juvenile with 35 (-1) somites (also including telson). Holotype with 54 (-1) somites, ca. 12 mm long and 0.8 mm wide. Coloration pinkish-yellow, head always a little paler, antennae invariably whitish to pale yellowish.

Head (Fig. 7) except rostrum very densely pubescent: latter not demarcated from head proper, more modestly and mainly laterally setose, dorsally almost to entirely naked, very long, almost pointed, in situ reaching almost to end of antennae. Latter stout, clavate, short, only antennomere 5 with a small but marked, pinkish, round field (= pit) of sensillae distodorsally, antennomere 7 normally hardly visible being drawn into preceding one. Gnathochilarium normal, distally with 3+3 particularly long and strong lateral setae. Collum about twice as long as following somite, fore margin medially modestly but clearly concave. Terga semicircular in outline, with neither carinae nor distinct swellings, laterally never protruding caudad. All tergal surface extremely densely and irregularly microtuberculate, interspaced with a thick and medium-sized pubescence (Fig. 7) on metaterga and, to a lesser degree, pleurites; prozona always naked, feeble microtuberculation in ca. six, rather regular, transverse rows gradually coming to naught toward fore edge. body subvermiform, very gradually and quite modestly broadening till somites 10-11, onward parallel-sided up to telson whereupon abruptly and roundly tapering. Epiproct subscapulate, broadly rounded, densely setose, entirely covering anal valves from above. Subanal plate small, inconspicuous. Pleurites subquadrate in shape, with inner margin modestly concave near middle. Ozopores inconspicuous, looking like very modest pits on top of very feeble knobs, starting from somite 5, always well removed from ventral edge, situated on anterior halves of metaterga until somites 11-12, at midlength on several subsequent metasegments shifting increasingly caudad onward, though never reaching close to rear tergal edge.

Legs (Fig. 8) short and stout, without particular modifications other than having densely setose and micropapillate sterna, two ventroparabasal and a dorsoproximal stronger seta on tarsi, and a large, complex claw which always has an additional, separate, basal tooth and a phylloid blade dorsally, the latter increasingly reduced toward hind body end.

Anterior gonopods (Figs 11-13) apparently 6-jointed, large, prominent, especially stout basally, their sternum practically normal, like a leg-bearing sternum, frontally densely setose. Coxite very short, stout, rudimentary, very much like subsequent 2-3 joints of telopodite. Latter 5-jointed at least, with some borders between separate podomeres hardly traceable, its last two joints more slender, terminal one lamellar, peculiarly setose distolaterally, truncate, 3rd joint making a drastic knee frontally and marking the beginning of a mesal excavation extending onward onto acropodite; excavation obviously designed for sheathing distal parts of posterior gonopods. Latter (Figs 9-10) much slenderer and more simple, definitely 7-jointed, in situ also curved cephalad in accordance with knee of anterior gonopods; last joint particularly slender, proximally with a minute mesal denticle, apically a bit broadened.

Remarks: Classification of the entire order Siphonophorida being a real mess (e.g., HOFFMAN, 1979), it is quite hard to adequately (re)allocate any species. Numerous nominate forms have been described only from females, many of them plus several others quite insufficiently, with the result that only about 50 hitherto known Siphonophoridae

may boast to be recognizable from the original descriptions. Most of them have been treated within either *Siphonophora* Brandt, 1837 or within *Siphonophorella* Attems, 1951. The problem remains the more so complicated as the former's type-species, *S. portoricensis* Brandt, 1837 from Puerto Rico, is still enigmatic, whereas the latter's generotype, *S. braueri* (Attems, 1900), a well-known species obviously indigenous in the Seychelles, has successively been placed in *Siphonophora* (e. g., ATTEMS, 1900), *Rhinosiphora* Verhoeff, 1924 (e. g., ATTEMS, 1930), *Siphonophorella* (e. g., ATTEMS, 1951; MAURIÉS, 1980a), and back in *Siphonophora* (MAURIÉS, 1980b). This is not that the species of Siphonophorida are too monotonous in structure, the main trouble seems to lie in the disagreement on which characters are to be generally admitted as specific or generic. At least the male genitalia appear to be fairly uniform in conformation, just like in the majority of colobognathans. In short, the above is perhaps enough as an excuse why the new Pakistani species has provisionally been described in *Siphonophora*. Geographically, the closest records of siphonophorids concern *Pterozonium coniceps* (Attems, 1936) from Darjeeling District, northeastern India, and *P. cingulatum* (Attems, 1936) from Darjeeling District and Indochina, both described but from females (s. ATTEMS, 1936).

#### ZOOGEOGRAPHIC COMMENTS

As noted earlier, the area where Drs Besuchet and Löbl managed their small collection of Diplopoda is practically a terra incognita, not only as regards northern Pakistan proper, but also on a far larger scale. Being familiar with the fauna of Soviet Middle Asia, I can say I was highly surprised to find in but a few samples representatives of so very different origins. The region lying between and formed by the great Hindu Kush, Hindu Raj, Karakorum, Himalaya Main Range, and Pir Panjal chains appears to be populated by a mixture of millipede faunal elements.

SILVESTRI's (1936) record of a *Polyxenus* sp. in Kashmir is not too difficult to interpret, for the genus is known to be chiefly Holarctic. Therefore, its attribution to Palearctic derivatives in the Kashmir list seems most likely.

Another Palaeartic component in the region's fauna is obviously represented by *Usbekodesmus* spp. So far as known, this genus comprises a single form, *U. redikorzevi* Lohmander, 1932, reported from Soviet Middle Asia (Uzbekistan, Tadjikistan) (LOHMANDER, 1932) and Afghanistan (environs of Belchiragh, Maimeneh Prov.), and further six species inhabiting the Himalayas of Nepal. The discovery of (a) congener(s) in northern Pakistan links the generic range at least to some extent.

*Usbekodesmus* has long been revealed as displaying particularly close affinities with *Epanerchodus*, a prolific genus encompassing over 60 nominate species or subspecies restricted to Japan, Korea, the Soviet Far East, as well as to the eastern, southern and central parts of China. Both genera may be believed to be immediate derivatives of the Indochinese *Pacidesmus*, so subtropical (South)east Asian roots of both Palearctic elements are clearly traceable.

*Bollmania* is another good example of Palaeartic influence on the faunal composition of the North Pakistani Diplopoda. Species of *Bollmania* have been reported from the Kopetdagh, Kuhitang-Tau, Ghissar-Darvaz, Pamir Mts. within Soviet Middle Asia (GOLOVATCH, 1979), from central and southern Iran (GOLOVATCH, 1983b), from



Badahshan and Kandagar Prov. of Afghanistan (LINDBERG, 1961, 1962), from Punjab, Hazara and Swat Prov. within northern Pakistan (ATTEMS, 1936, and above). Besides, a closer unidentified *Bollmania* or *Bollmania*-like form has been recorded from Kiangsu Prov., South China (GOLOVATCH, 1981). Thus the pattern becomes very much like that of *Usbekodesmus*, with the roots obviously lying in the subtropical areas of southern China, where one more callipodidan genus (and family?) has just been encountered (MAURIÈS, personal communication).

Whereas both *Usbekodesmus* and *Bollmania* represent unquestioned Palaearctic components in the diplopod fauna of North Pakistan, numerous other millipedes there seem rather to be Oriental in origin. Thus, Heterochordeumatidae have hitherto been known but by two genera, one from Sumatra and the other from Burma, soundly considered as the most primitive in the entire order Chordeumatida. The discovery of a (?)third genus in northern Pakistan is the more so striking as the gap between Burma and Kashmir is not at all so poorly explored, with the Chordeumatida being represented by the much more advanced *Kashmireuma* (one species in Kashmir and two more in Nepal), *Tianella* (2 spp. from the Tien-Shang Mts., 11 from Nepal, and at least two more, yet undescribed forms from Darjeeling Distr., North India), and *Nepalella* (11 spp. in Nepal, one in Burma, Thailand and Vietnam apiece) (s. MAURIÈS, 1988), but nothing like heterochordeumatids. This leads one to the conclusion that the less elevated and more mild areas of modern North Pakistan seem to have retained particularly ancient faunal elements as compared to the adjacent extremely high and severe Himalayas nowadays supporting only relatively more advanced, younger forms. By the way, the presence of *Tianella* in the region concerned may be predicted with fair confidence, this attributable then to the Palaearctic components in the local fauna.

*Anaulaciulus*, perhaps one of the largest genera in the family Julidae, is known to comprise 34 nominate species or subspecies mainly confined to East Asia within Japan, Korea, the Soviet Far East, and eastern China, but also encountered in the Philippines, Indochina, Burma, central China, Tibet, the Himalayas of Bhutan, Sikkim, Nepal, and Kashmir (s. ENGHOFF, 1986). Dr. Enghoff (personal communication) advised me that the samples taken by Drs Besuchet and Löbl in North Pakistan do contain some *Anaulaciulus*, thus representing probably the northwesternmost record of that genus. Its general pattern vividly reminds of that of the *Usbekodesmus-Epanerchodus* lineage, *Bollmania* or *Tianella* (see above), displaying obviously still one more case of Palaearctic elements (sub)tropical in origin.

As regards the paradoxosomatid genus *Kaschmiriosoma*, it seems to belong to the chiefly Asian tribe Sulciferini and consists of one species from Kashmir (*K. contortipes* Schubart, 1935) (s. SCHUBART, 1935; SILVESTRI, 1936; GOLOVATCH, 1983a, 1984), one from Punjab Prov. in North Pakistan (*K. pleuroptera* (Attems, 1936)) (s. ATTEMS, 1936), one more from Himachal Pradesh in North India (*K. nulla* (Attems, 1936)), and two undescribed forms from Nuristan and Hindu Kush in Afghanistan (LINDBERG, 1961). *Kaschmiriosoma* seems to be especially close to the Indian *Parchondromorpha*, and the discovery of (a) *Kaschmiriosoma* in North Pakistan is thus easy to predict. *Kronopolites* belongs to the same tribe and encompasses *K. swinhoei* (Pocock, 1895) (Shantung, Chekiang, Szechuan, Kansu and Hangchow Prov. in central and southern China), *K. formosanus* (Verhoeff, 1939) from Taiwan, *K. acuminatus* (Attems, 1937) from North Vietnam, *K. biagreluctus* Hoffman, 1963 from Kiangsi Prov., China, *K. fuscocingulatus* Jeekel, 1983 from North Thailand, and *K. occidentalis* Golovatch, 1983 from Kashmir. *Delarthrum* is a monobasic (with the type-species *D. obscurum* Attems, 1936 from



northern Pakistan) genus belonging in the Indian and Farther Indian subfamily Alogolykinae. Finally, if Lohmander's identification of his *Pratinus lindbergi* nom. nud. from a cave nearby Narang in Hindu Kush, eastern Afghanistan (s. LINDBERG, 1961), really refers to that genus, which is known now to be but a junior synonym of *Desmoxytes*, then we face a member of the tribe Hylomini otherwise restricted to Sri Lanka, Burma, Malaya, Thailand, and central China. Only one form, *D. planata* (Pocock, 1895), has attained a vast distribution in the (sub)tropical areas due to anthropochorous introductions. The presence of all the above Indian and/or Farther Indian genera of Paradoxosomatidae in Kashmir and the immediately adjacent areas of northern Pakistan and northeastern Afghanistan is surely evidence of a pronounced influence of the Oriental realm on the faunal composition of Diplopoda in the region in question.

Both *Quasidesmus* and *Siphonophora* can be attributed to doubtless (sub)tropical faunal elements, most probably also Oriental in origin, for their respective families, Pyrgodesmidae and Siphonophoridae, are known to be quite widespread in the tropical and, to a lesser extent, subtropical regions of the world. Both families are desperately confused taxonomically and, in Asia, display a particularly pronounced diversity in the Indian, Farther Indian and Australasian realms. Unfortunately, the nearest and very rich collections of these families I have seen, effectuated in Nepal by Prof. Dr. J. Martens (Mainz), still require treatment. I am fairly sure that their identification will shed quite an important light on the still somewhat obscure relationships of the two genera concerned.

The above pattern of diplopod zoogeography in the famous mountainous area lying south of the Pamirs and flanked by the great chains of Hindu Kush and Hindu Raj from the west, and of Karakorum, Himalaya and Pir Panjal from the east, though highly preliminary as it is, generally agrees very well with the data already known for numerous other animal groups. For instance, when providing a rough outline of zoogeography of Kashmir based on mammals, birds, reptiles, amphibians, freshwater fishes, land and freshwater mollusks, freshwater crustaceans, insects, rotifers, sponges, DAS (1967) emphasized that the fauna in toto is soundly attributable to the Oriental region, being actually its northwesternmost corner. However, penetration of Palaearctic elements is so considerable against the background of a relative dominance of Oriental derivatives that it ensures the fauna's highly mixed character comparable perhaps only to the great zone of intergradation between the Palaearctic and Oriental regions in eastern Asia. Being generally a hygro- to mesophilous group of mainly forest-dwellers, Diplopoda appear to nicely confirm the above pattern, although future explorations are bound to reveal many important details.

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